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A PRELIMINARY REPORT ON THE OSTRACODA OF THE BENGUELA CURRENT

By

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(Text-figs. 1–5)

INTRODUCTION

The R.R.S. 'William Scoresby' carried out two surveys of the Benguela current in 1950, the first in March, and the second in September–October. Some of the results of these surveys have been briefly described by Hart (1953) and Currie (1953), but some time will no doubt be needed for the full analysis of the data, and especially for examination of the collections of plankton. Dr T. J. Hart has carried out the laborious task of sorting the samples of zooplankton, and at the invitation of Dr N. A. Mackintosh I undertook to examine and report upon the Ostracods. The sorting has been so effective that I have received all the material from the first survey, including the early juvenile stages. The present report is based on this material: that is to say it is limited to the first of the two surveys, and at this stage I have thought it best simply to give an account of the species identified, to note the numbers in which they occur in the samples, and to draw attention to certain aspects of their horizontal and vertical distribution. It is hoped that a report on these lines will materially assist a wider study of the fauna of the Benguela current and its relations to the hydrographic features of this interesting region.

With the exception of a very few species the planktonic Ostracods of the open sea belong to a single family, the Halocypridae. Previous marine expeditions have provided material that has made possible the recognition of what is probably the majority of the existing species of the family. A series of workers (Claus, Brady, Müller, Vavra, Sars, etc.) have worked out these collections but their descriptions are mainly limited to a few diagnostic features. More recently Skogsberg (1920, 1946) re-described certain species and drew attention to the inadequate nature of the previous descriptions. Although, as he pointed out, taxonomic revision of the family is clearly needed, re-description of many more species will be necessary before this can be done. However, I have decided that it would be preferable to postpone re-description of the species considered in this report until material with a much wider range of distribution has been examined. The species found in the samples have thus, with one exception, been determined and classified on the basis of existing taxonomic knowledge. They are listed below with the appropriate authorities. The juvenile stages of the Halocypridae have not been adequately described in the literature and therefore the early stages whose identity cannot yet be established have been listed as 'unidentified juveniles'. Numerical data regarding material from the samples are included in the tables, which form an appendix to this report.

I wish to acknowledge my indebtedness to the National Institute of Oceanography for the opportunity of examining the material. I should also record my sincere thanks to Dr Mackintosh for the trouble he has taken in reading through and checking the typescript, and to Dr Hart for the information he has supplied. Dr J. P. Harding of the British Museum (Natural History) has very kindly given me details of the type material of *Halocypris punica* Scott. Finally, I wish to thank Prof. H. Graham Cannon for introducing me to the field of study of Ostracod taxonomy and for his continued interest and advice during the progress of my work.

THE MATERIAL EXAMINED

The plankton samples of the first survey were taken on a series of three transverse lines of stations across the Benguela current off the coast of South-west Africa (Fig. 1).[1] These samples were taken with a series of vertical closing nets of the N 70 pattern shot to a maximum depth of 1000 metres or less, depending upon the depth of water at the station. The soundings show that the outermost station of each line was in a depth of water of some 2000 m. or 3000 m., while the lines then proceeded up the Continental Slope, a few stations in each being over the Continental Shelf.

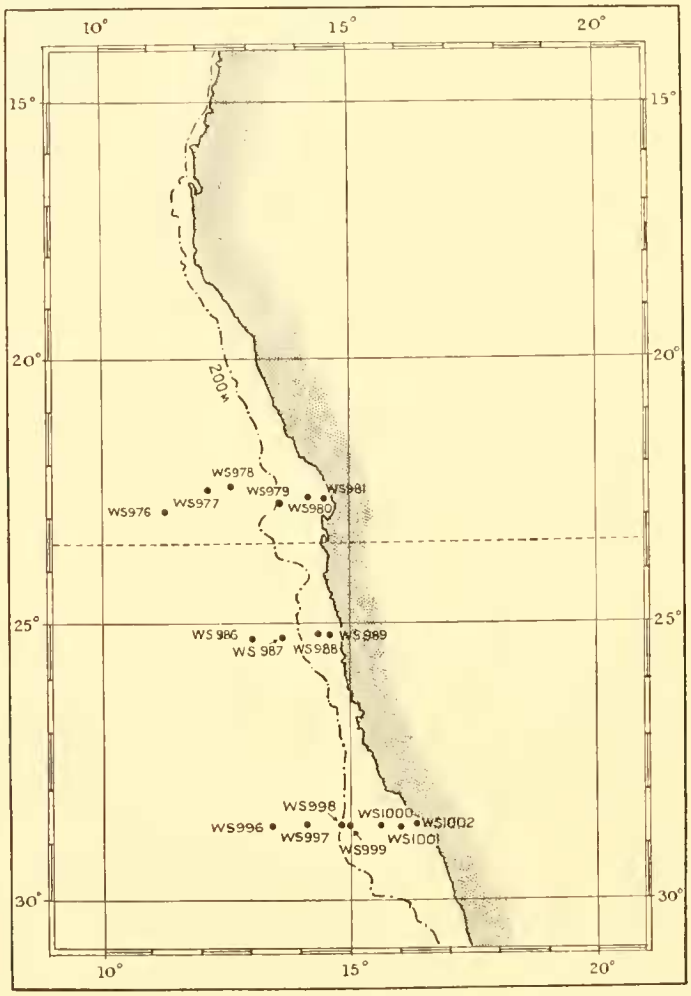


Fig. 1. Sketch-map of the area off the west coast of Africa where samples were taken, showing the approximate positions of the stations.

SPECIES PRESENT IN THE SAMPLES

Conchoecia rotundata Müller aff.

Skogsberg (1920) pointed out that the species *C. rotundata* as described by Müller (1906) is probably a mixture of closely allied species, and the material from the Benguela current has made it possible to confirm this hypothesis.

Müller (1890) described the species *C. rotundata* on the basis of a few specimens obtained in deep water at two positions in the tropical Pacific. These were in 13° N., 120° W. at a depth of 1000 m., and in 1° S., 100° W. at 4000 m. (According to Schott (1935, pp. 199–203) the temperatures at

[1] Particulars have now been published in a new Station List in the Discovery Reports.

these depths were 4·60° C. and 1·85° C. respectively). The description was brief and even failed to give adequate details of the unsymmetric glands. The same author (1894) ascribed material from the Mediterranean to the same species. The length of typical specimens in this material was only 0·8 mm. as opposed to 1·15 mm. in the case of the Pacific material, and there were fewer pairs of spines on the principal seta of the male antennule (eight instead of ten). The frontal organ of the male also differed.

The 'Valdivia' Expedition provided a large quantity of material from the Atlantic and Antarctic including species allied to *C. rotundata*, which Müller (1906) distinguished and named. It included material which resembled his previous specimens of *C. rotundata*, and also longer specimens (up to 1·75 mm. in length) with similar features, such as the position of the unsymmetric glands. He included the longer forms in the same species. He noted that the 'long forms' were typical of the Antarctic and the 'short forms' of warmer waters, but assumed that he was dealing with a very variable species.

Fowler (1909), while studying the planktonic Ostracoda of the Bay of Biscay, obtained specimens of both the 'long' and 'short forms'. He interpreted the two 'forms' on the basis that the 'long forms' were adult and the 'short forms' juveniles of the same species.

Further material from the Antarctic was examined by Skogsberg (1920). He obtained specimens of the 'long forms' and described them in some detail, noting that they agreed with the 'long forms' described by Müller. He did not find any of the 'short forms', considered that Fowler was mistaken in supposing them to be juveniles, and decided that they belonged to a nearly related species, possibly *C. nasotuberculata*. He concluded in fact that Müller's *C. rotundata* might be a mixture of closely allied species.

The samples collected by the 'William Scoresby' in the Benguela current provide further material of both the 'long forms' and the 'short forms' of *C. rotundata* as described by Müller (1906). Both these 'forms' occur at the same stations and in some instances in the same samples. There are fully matured male and female specimens and also juveniles of each type. The use of closing-nets and the numbers of adults of each form in each sample shows that there is a clear difference in their depth distribution. Table 1 gives the total number of 'short forms' of *C. rotundata* taken at the different stations, and the proportion collected at depths above 250 m. is compared with the figures for the 'long forms' and for *C. nasotuberculata*. Only one specimen from a total of twenty-three 'long forms' was captured above 250 m., whereas many more 'short forms' occurred in samples taken above 250 m. than below. *C. nasotuberculata*, clearly distinguishable morphologically from the 'short forms', occurs in the same samples. Its depth distribution (Table 1) falls somewhat between that of the two 'forms' under consideration.

Table 1. *Comparative depth distribution of 'long' and 'short forms' of* C. rotundata *and* C. nasotuberculata

Station	'Short forms'			'Long forms'		*C. nasotuberculata*		
	Total No.	Above 250 m.		Total No.	Above 250 m.	Total No.	Above 250 m.	
		No.	%		No.		No.	%
WS 976	73	47	64	1	0	21	1	5
WS 977	23	21	91	7	0	47	21	45
WS 978	9	7	78	5	0	36	3	8
WS 980	1	1	100	0	0	0	0	0
WS 986	7	6	86	7	0	39	7	18
WS 996	9	8	89	2	1	9	3	33
WS 997	2	2	100	0	0	1	0	0
WS 998	1	1	100	0	0	0	0	0

An examination of the material shows clear morphological differences between the two 'forms'. Specimens of the 'long form' agree in structure with those described by Skogsberg (1920) from his Antarctic material. The 'short forms' agree in structure with the material from the Mediterranean described by Müller (1894) as *C. rotundata*.

As Skogsberg (1920) has pointed out, the form of the shell is a characteristic feature of the species of *Conchoecia*. This differs markedly in the two 'forms' considered here. The 'long forms' have a greater ratio of length to depth and their greatest depth is anterior to the middle of the length, as opposed to posterior in the 'short forms'. They have, in the material so far examined, a length of 1·4 mm. or more, as opposed to 0·8–0·9 mm. in the case of the 'short forms'. Although the form and spacing of the spines of the principle ('*e*') seta of the male antennule is similar in the two, the 'long forms' have 14–15 pairs whereas the 'short forms' have 9–10 pairs. The clasping organ of the endopodite of the right male antenna in the 'short forms' is similar to that of *C. kyrtophora* or *C. nasotuberculata*, being sharply angled rather than smoothly curved as in the case of the 'long forms'. The frontal organ of the male is similar in the two but the 'long forms' have a dorsal insection which is absent in the 'short'.

Through the kindness of the authorities of the British Museum (Natural History), it has been possible to re-examine Fowler's material from the Bay of Biscay. His stage I of *C. rotundata* agrees with the 'long forms' and his stage II with the 'short forms'.

It is clear that the two 'forms' are separate species, the 'short form' typical of the Mediterranean and warmer waters of the Atlantic, the 'long form' characteristic of the Antarctic and colder water, at least in the Atlantic. The problem of specific identity remains. Both these species have previously been ascribed to *C. rotundata* Müller. The original description (Müller, 1890) is inadequate even in respect to diagnostic characters. On the basis of the described and figured outline of the shell and the ten pairs of spines on the principal seta of the male antennule, together with the length of 1·15 mm. as opposed to 1·4 mm. or more in the 'long forms', it is clear that the latter are specifically distinct and must be renamed. Morphological differences between the 'short forms' and the type description of *C. rotundata* are slight and may or may not be significant. The length of the specimens under consideration, as well as that of Müller's Mediterranean material, is less than that of his Pacific material. The shape of the male frontal organ in the original description more nearly resembles that of the 'long forms'. It would therefore seem preferable to treat the two 'forms' as distinct species.

Müller (1912) included *Halocypris punica* Scott (1894) as a possible synonym of *Conchoecia rotundata* and it is necessary therefore to consider the possibility of this name being applicable to either species. As Skogsberg (1920) has pointed out, the original description is of a specimen differing so much that it is unlikely to be a synonym of *C. rotundata*. Dr J. P. Harding of the British Museum has very kindly examined the type material. The tube contains the shell of the animal described by Scott, together with other obviously unrelated material. It is clear that it differs so widely that it cannot be the same species as either *C. rotundata* or the two species considered here.

The specific name *C. rotundata* should thus, for the present, be restricted to the Pacific material described by Müller (1890, p. 275, pl. XXVIII, figs. 41–3; pl. XXIX, fig. 44). The other two species have been named as follows:

Conchoecia skogsbergi n.sp. ('long forms').

C. rotundata (part) Müller, 1906, p. 83 (part); pl. XVII, figs. 25–9 (not 23–4); (?)figs. 30–4.
C. rotundata (Stage I) Fowler, 1909, p. 273; pl. 23, fig. 206; pl. 24, figs. 205, 215.
C. rotundata (part) Müller, 1912, p. 77.
C. rotundata Skogsberg, 1920, p. 649 *et seq.*; figs. CXXII and CXXIII.

The description and figures given by Skogsberg (1920, p. 649) under the name *Conchoecia rotundata* may be taken as typical for this species. Type material will be deposited at the British Museum. The distribution known at present is in the Antarctic and colder waters of the Atlantic, distribution northwards possibly being due to the cold Benguela current. In the present series of samples moderate numbers of adults and juveniles occurred at Stations WS 976–8, 986 and 996 mainly at depths below 250 m. A single juvenile was in the 500–250 m. sample from Station WS 997.

The species may be distinguished from other known species of the genus *Conchoecia* by the shape of the shell coupled with the position of the unsymmetric glands. Confirmatory characters of the male are the number of pairs of spines on the principal seta of the antennule, the form of the clasping organ of the antenna and the frontal organ.

The new specific name has been chosen in acknowledgement of Skogsberg's realization that more than one species might have been confused under the name *C. rotundata*.

Conchoecia teretivalvata n.sp. ('short forms').

C. rotundata Müller, 1894, p. 229; pl. 16, figs. 16, 18–20 (not fig. 17); pl. 8, fig. 33.
C. rotundata Müller, 1906, p. 83 part.
C. rotundata (stage II) Fowler, 1909, p. 273.
C. rotundata (part) Müller, 1912, p. 77.

Diagnostic description. *Male.* Length 0·8–0·9 mm. Shell (Fig. 2*a*) resembling that of *C. kyrtophora* in profile, but with the shoulder vaults poorly developed and the whole surface smoothly convex as in the case of *C. skogsbergi*. The posterior dorsal angle is strongly obtuse, the posterior margin being convex and continuing smoothly into the ventral margin. The greatest depth of the shell valves is just posterior to the middle of the length, and the depth decreases sharply anterior to this point. The left unsymmetric gland (Fig. 2*b*) is situated near the base of the rostrum, just posterior to the anterior extremity of the hinge. The right unsymmetric gland (Fig. 2*c*) opens level with the margin of the shell near the posterior extremity of the hinge, there being no tubercle. Medial glands are moderately well developed. Striation of the shell is similar in arrangement to that of *C. nasotuberculata* but very weak and difficult to observe.

The principal ('*e*') seta of the antennule (Fig. 3*c*) has nine or ten pairs of spines arranged in two rows with the spines of each pair level with one another. Each spine is sharply basally directed, parallel to the seta. The more basal spines are slightly longer than the more distal and the three most basal pairs succeed one another at wider intervals than the distal pairs. The proximal setae have a few extremely fine distally directed setules level with the distal spines of the principal seta.

The endopodite of the antenna closely resembles that of *C. skogsbergi* (see Skogsberg, 1920, under *C. rotundata*) but the clasping organs differ. The right clasping organ (Fig. 3*b*) is bent at a right-angle and has the apical portion slightly recurved. It has well-marked transverse striae distally. The left clasping organ (Fig. 3*a*) is smoothly curved and slightly recurved at the apex. The apical transverse striae are indistinct.

The dorsal boundary of the capitulum of the frontal organ (Fig. 2*d*) is slightly and smoothly concave. Basally it is considerably swollen, which portion bears a few conspicuous ventral spines.

Female. Length about 0·9 mm. The shell (Fig. 2*f*) resembles that of the male in general features though it has a greater depth in proportion to its length. It lacks the well-marked shoulder vaults and posterior tubercle, which are present in the similar species, *C. kyrtophora* and *C. nasotuberculata*.

The frontal organ (Fig. 2*e*) has a capitulum with a length slightly more than four times the breadth, and slightly tapering anterior to the middle of its length. The apex is rounded and the whole ventral margin bears short fine spines.

Present knowledge indicates that the distribution of this species is in the Mediterranean and the warmer waters of the Atlantic. In the Benguela current samples it occurred at Stations WS 975–8, 980, 986 and 996–8, with a much larger number of specimens in samples above 250 m. than below.

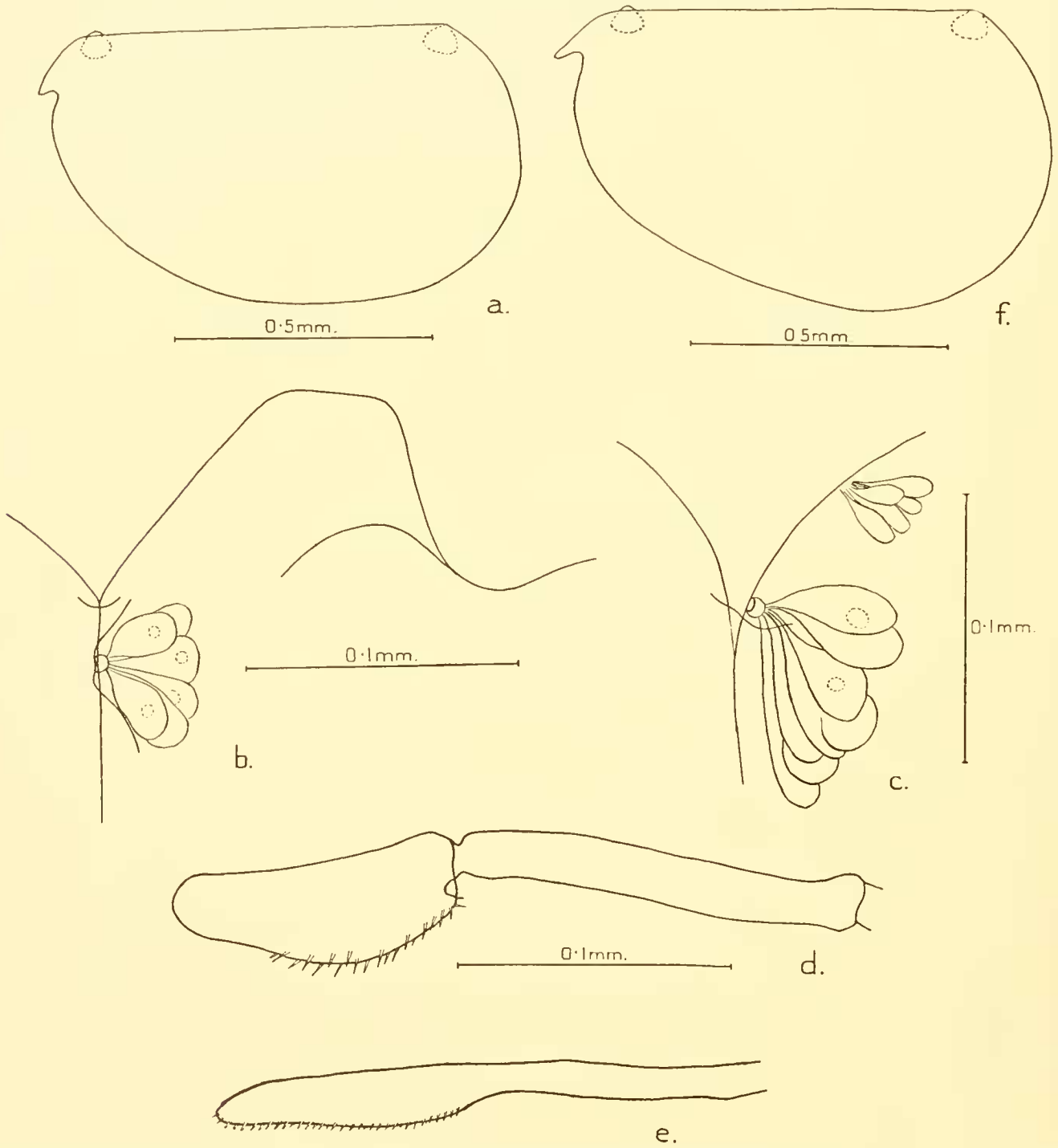


Fig. 2. *C. teretivalvata* n.sp. *a*, male from left side; *b*, anterior (left) unsymmetric gland of male from inside the shell; *c*, posterior (right) unsymmetric gland and medial gland of male from inside the shell; *d*, frontal organ of male; *e*, frontal organ of female; *f*, female from left side. (Figs. *b*, *c*, *d* from holotype; *a*, *e* and *f* from paratypes.)

The species may be distinguished from other species of the genus, except *C. rotundata* Müller, by the form of the shell coupled with the position of the unsymmetric glands. As far as is known, it differs from *C. rotundata* morphologically in its size, and in the form of the male frontal organ, as well as in its distribution.

Other species present in the samples were as follows:

Conchoecia alata Müller.

Conchoecia alata Müller, 1906, p. 121; pl. 29, figs. 1–10.
C. alata Müller, 1912, p. 92.

Numerous specimens at Stations WS 976–8, 986, 996, 997.

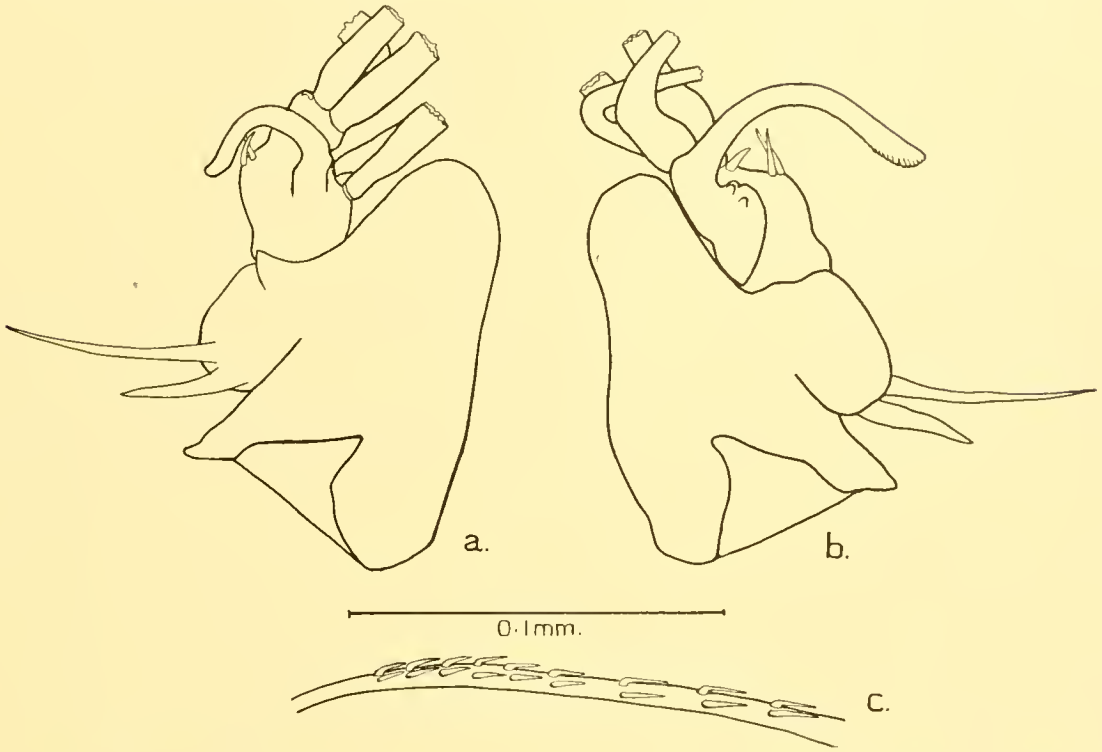


Fig. 3. *C. teretivalvata* n.sp. *a*, exopodite of male left antenna; *b*, exopodite of male right antenna; *c*, armature of principal seta of male antennule. (All from holotype.)

Conchoecia bispinosa Claus.

For synonymy and description see Skogsberg, 1920, p. 672, fig. CXXVIII.

This species occurred in samples from stations WS 976, 986, 996 and 997. Skogsberg (1920) has pointed out the close resemblance between this species and *C. haddoni* Brady & Norman. The two species are distinguishable by the short spines on the posterior dorsal angle of the shell of *C. bispinosa* and the number of spines on the principal setae of the first antennae of the males. Skogsberg states (1920, p. 675) that the areas of distribution of the two species do not coincide. Müller (1906, 1908), however, recorded the two species from the same plankton samples, and in the samples at present under consideration they also occur together. There must then be at least an overlap in their distribution.

Conchoecia chuni Müller.

For synonymy and description see Skogsberg, 1920, p. 636, fig. CXIX.

A single adult female occurred in the 250–100 m. sample from Station WS 996.

Conchoecia curta Lubbock.

The synonymy of this species is extremely complex and uncertain. Skogsberg (1920) discussed the position and re-described the species. The material from the Benguela current first survey clearly falls within the scope of the species as described by him. It was present in large numbers, of both adults

and juveniles, in samples from Stations WS 976, 978, 986, 996 and 997. A single juvenile was found in the 100–50 m. sample from Station WS 1001. It clearly formed a major part of the Ostracod fauna in the area at the time when the samples were taken. Certain features of its distribution will be discussed later in this report.

Conchoecia daphnoides (Claus).

For synonymy and description see Skogsberg, 1946, pp. 20–4, fig. v, 1–4.

An adult female of this species was found at Station WS 986 and single adult males at Stations WS 996 and 997. A juvenile was found at Station WS 976. All specimens were in the 750–500 m. samples.

Conchoecia echinata Müller.

Conchoecia echinata Müller, 1906, p. 61; pl. 10, figs. 14–24.
C. notocera Vavra, 1906, p. 58; pl. 6, figs. 114–20.
C. echinata Müller, 1908, p. 3.
C. echinata Müller, 1912, p. 70.

Present at Stations WS 976–8, 986, 996 and 997

The previously recorded range of this species extends from 31° N. (Vavra, 1906) to 14° S. (Müller, 1908) in the Atlantic. The material from the Benguela current stations extends the range of the species further south.

Conchoecia edentata Müller.

Conchoecia edentata Müller, 1906, p. 76; pl. xv, figs. 24–9.
C. edentata Müller, 1912, p. 74.
C. edentata Barney, 1921, p. 183–4, fig. 5.

A single female of this species was found in the 500–250 m. sample from Station WS 976.

The species was initially described by Müller (1906) on the basis of a single male and a juvenile female, which latter he did not describe. Barney (1921) found two males and two females which he ascribed to the species and gave a brief description of the female. All these previous specimens were found in the Antarctic. The present specimen agrees so closely with the previous descriptions as to warrant inclusion in the species. It is, however, further north than previously recorded.

Conchoecia elegans Sars.

For synonymy and descriptions see Skogsberg, 1920, p. 624, figs. cxvii and cxviii, and Sars, 1928, p. 23, pls. xi and xii.

A large proportion of the specimens found in the samples belongs to this species. It was found at Stations WS 976–8, 986, 996–8. Its distribution will be discussed in more detail later in this report.

Conchoecia haddoni Brady & Norman.

For synonymy and description see Skogsberg, 1920, p. 668; fig. cxxvii.

A few specimens were present in the samples, most of them from Station WS 996. Single adult females were found at Stations WS 976 and 997, as were also single juveniles. See also remarks under *C. bispinosa* above.

Conchoecia hirsuta Müller.

Conchoecia hirsuta Müller, 1906, p. 60; pl. 11, figs. 1–3 and 6–10; 1908, p. 69; 1912, p. 66.

A single male of this species was found in the 1000–750 m. sample at Station WS 986.

Conchoecia lophura Müller.

For synonymy and description see Skogsberg, 1920, p. 689, fig. CXXXI.

Single adults of this species were present in samples from Stations WS 976, 986 and 997. There were two juveniles in samples from WS 986 and one from Station WS 996.

Conchoecia loricata (Claus).

Conchoecissa loricata Claus, 1894, p. 4; pl. 3, fig. 24–30.
Conchoecia loricata Müller, 1906, p. 95; pl. 22, figs. 1–9.
C. loricata loricata Müller, 1912, p. 80.

A few specimens of adults and juveniles of this species occurred in samples taken below 250 m. at Stations WS 976–8, 986, 996 and 997.

Müller (1906) distinguished two varieties of the species, which he called var. *typica* and var. *minor*. The latter differed from the former in being smaller, having only twelve pairs of spines on the proximal seta of the antennule instead of about twenty-two, and having less marked striae on the shell. In a later publication (1912) he refers to the former as *C. loricata loricata*. The present material would appear to fall within the scope of *C. loricata loricata* though it has fewer spines on the proximal seta. The range of variation and status of the 'varieties' cannot be determined before a considerably greater bulk of material has been examined.

Conchoecia macromma Müller.

Conchoecia macromma Müller, 1906, p. 79; pl. 17, figs. 11–22.
C. macromma Müller, 1912, p. 75.

A single adult female of this species was present in the 1000–750 m. sample from Station WS 986.

Conchoecia mamillata Müller.

Conchoecia mamillata Müller, 1906, p. 60; pl. 16, figs. 1–9; pl. 35, fig. 8.
C. mamillata Müller, 1912, p. 70.

A single adult female was found in the 1000–750 m. sample from station WS 976.

(?) Conchoecia mollis Müller.

Conchoecia mollis Müller, 1906, p. 106; pl. 24, figs. 1–10 and 13.
C. mollis Müller, 1912, p. 85.

A single adult female was found in the sample collected between 1000 and 750 m. at Station WS 996, which if not *C. mollis* itself is closely related to it. Existing descriptions only make it possible to distinguish the males of the group of species allied to *C. mollis*, and until more detailed descriptions of the females are available, doubt must remain regarding the identity of this particular specimen.

Conchoecia nasotuberculata Müller.

Conchoecia nasotuberculata Müller, 1906, p. 83; pl. 18, figs. 25–30.
C. nasotuberculata Müller, 1912, p. 76.

This species occurred in large numbers at Stations WS 976–8, 986, 996 and 997. Distributional data of this species will be discussed later in the report.

Conchoecia obtusata Sars var. *antarctica* Müller.

For description and synonymy see Skogsberg, 1920, p. 647.

The species occurred in moderate numbers at Stations WS 976, 977, 996, 997 and 998. The previously recorded range of distribution of the species was in the Atlantic from 53° S. (Skogsberg, 1920) to 26° S. (Müller, 1906). The present records thus extend the distribution in the Benguela current further north to 22° 39′ S. Müller (1906, p. 149) considered that although the variety is typically Antarctic in its distribution its range is extended northward by the cold Benguela current. The present records are not then surprising.

Conchoecia procera Müller.

Conchoecia variabilis (part) Müller, 1890, p. 273; pl. 28, figs. 27, 38.
C. procera Müller, 1894, p. 228; pl. 6, figs. 47, 48, 50–8.
Paraconchoecia oblonga Claus, 1894, p. 3; pl. 3, figs. 21–3.
C. procera Müller, 1906, p. 71; pl. 13, figs. 37–47; pl. 14, figs. 3–6.
C. procera Müller, 1912, p. 72.

A few adults of this species were found in samples from Stations WS 976 and 996. A single juvenile was found in the 500–250 m. sample from Station WS 977.

Conchoecia spinifera (Claus).

Paraconchoecia spinifera Claus, 1890, p. 14.
P. spinifera Claus, 1891, p. 64; pl. 10.
Conchoecia spinifera Müller, 1906, p. 56; pl. 9, figs. 1–10, 14, 15.
C. spinifera Müller, 1912, p. 69.

A single adult female occurred in the 500–250 m. sample from Station WS 996 and a single adult male in the 500–250 m. sample from Station WS 976.

Conchoecia subarcuata Claus.

For description and synonymy see Skogsberg, 1920, p. 695 and fig. CXXXIII.

Moderate numbers of this species were present in the samples from Stations WS 976–8, 986, 996 and 997.

Conchoecia symmetrica Müller.

For description and synonymy see Skogsberg, 1920, p. 719 and figs. CXXXVIII–CXLIV.

Moderate numbers were present in samples from Stations WS 976–8, 986, 996 and 997.

Halocypris brevirostris (Dana).

For description and synonymy see Skogsberg, 1920, p. 584; figs. CXII–CXV.

A single juvenile of this species was found in the sample from 250–100 m. at Station WS 997.

Cypridina sp.

A single unidentified juvenile of the genus *Cypridina* was found in the 250–100 m. sample from Station WS 978.

DISTRIBUTION OF SPECIES

Owing to the wide range of variables involved in the present limited series of samples available, it is not yet possible to interpret the distribution of species fully. As Fowler (1909) has pointed out there is an almost hourly variation in the distribution of Ostracods. Some numerical data are, however, worthy

of note. Only adults will be considered, since outstanding taxonomic problems regarding the juvenile stages make a complete analysis of these stages impossible at present. The data only refer to the time and conditions when the samples were taken.

Table 2 shows the total numbers of adults of each species captured at each station. The first striking feature is the large number of species of Halocyprids present in such a limited area. The second is the vast preponderance of *Conchoecia elegans*. Müller (1927), Elofson (1941) and others pointed out the cosmopolitan nature of this species, so that its presence is not surprising, but its large numbers will

Table 2. *The sounding and total numbers of adults of each species captured at each station*

WS Station	Sounding (m.)	*C. alata*	*C. bispinosa*	*C. chuni*	*C. curta*	*C. daphnoides*	*C. echinata*	*C. edentata*	*C. elegans*	*C. haddoni*	*C. hirsuta*	*C. lophura*	*C. loricata*	*C. macromma*	*C. mamillata*	*C. mollis* aff.	*C. nasotuberculata*	*C. obtusata*	*C. procera*	*C. skogsbergi*	*C. spinifera*	*C. subarcuata*	*C. symmetrica*	*C. teretivalvata*
976	ca. 3098	20	20	0	68	0	14	1	177	1	0	2	2	0	1	0	21	9	4	1	1	6	5	73
†977	1970*	18	0	0	2	0	5	0	192	0	0	0	1	0	0	0	47	1	0	7	0	4	1	23
†978	932	19	0	0	1	0	1	0	78	0	0	0	1	0	0	0	36	0	0	5	0	3	0	9
979	139	One adult *C. teretivalvata* at Station 980																						
980	106																							
981	64																							
986	> 1000	4	2	0	10	1	2	0	118	0	1	1	3	1	0	0	39	0	0	7	0	2	2	7
987	293	No adult Ostracods																						
988	135																							
989	70																							
996	2586*	3	3	1	20	1	2	0	134	8	0	0	1	0	0	1	9	5	1	2	1	0	3	9
997	1075–983	2	3	0	13	1	1	0	14	1	0	1	0	0	0	0	1	10	0	0	0	3	5	2
998	198	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
999	171	No adult Ostracods																						
1000	188																							
1001	121																							
1002	69																							

* Soundings not at actual station but nearby.

† Omitting duplicate samples and those in which the net failed to operate correctly.

require explanation when further data become available. *C. curta*, *C. nasotuberculata* and *C. teretivalvata* were also present in large numbers. Though *C. alata* was less numerous, it occurred in sufficient numbers to form an appreciable proportion of the material, particularly in samples between 250 and 750 m. Other species were much less numerous, but some occurring in total numbers of from sixteen to twenty-five were sufficiently evenly distributed to be considered typical of the particular series of samples. In the case of *C. bispinosa*, although a total of twenty-eight adults was found in the samples, nineteen of these were from 500–250 m. and 750–500 m. samples from Station WS 976. It would seem that when the samples were taken at this daylight station there may have been a localized swarm of this species.

As has been pointed out above, *C. echinata* has now been found south of its previously recorded range of distribution and *C. obtusata antarctica* north of its previously recorded range. *C. teretivalvata*,

a species typical of warmer waters, is present in the samples nearer the surface, and *C. skogsbergi*, typical of colder waters, is present in deeper samples. These instances are probably a result of the influence of the Benguela current.

Two previous expeditions, the 'Valdivia' (Müller, 1906) and the German South Polar (Müller, 1908), obtained plankton samples from the Benguela current in latitudes similar to those of the present series but further from the coast. All the species recorded here, with the exception of *C. echinata* and *C. obtusata antarctica*, were recorded by these expeditions. It is of interest to compare the species occurring in the Benguela current with those described from the east coast of Africa (Cannon, 1940). Cannon recorded *C. alata* and *C. atlantica* as the most numerous species. The second of these is totally absent from the present series of samples, though it is known to occur in similar latitudes out in mid-Atlantic.

The data given in Table 2 show the significant fact that along each line of stations, with a few minor exceptions, the nearer the stations were to the coast the fewer the number of adults of each species captured. At those stations where the sounding was less than 200 m., a single adult *C. teretivalvata* was captured at Station WS 980, and at Station WS 998 (near the edge of the Continental Shelf) single adults of *C. elegans*, *C. obtusata* and *C. teretivalvata* were taken in a 175–100 m. sample. Otherwise no adults were present. The comparatively small depth of water over the Continental Shelf will naturally limit the spread of those species which only occur in deeper water, though of course there may be other reasons for the scarcity of Ostracods in shallow water. An absence of specimens in the samples, however, does not necessarily indicate a complete absence of a species from the area in which the sample was taken. A comparison of the number of adults present in the 50–0 m. and 100–50 m. samples in the deeper water stations with the number in similar samples taken over the Continental Shelf shows marked differences. Thus in the six 50–0 m. samples taken at stations where the sounding was 932 m. or more, a total of 105 adults was found, an average of over seventeen per sample, and neglecting *C. elegans* at Station WS 977, for reasons which will be pointed out later, there was a total of twenty-two adults, an average of almost four per sample. Only two of the six samples were devoid of adult specimens. On the other hand, in twelve similar samples taken at stations where the sounding was 293 m. or less, there was not a single adult Ostracod. In six samples from the 100–50 m. net, taken at stations where the sounding was 932 m. or more, there was a total of forty-three adult Ostracods, an average of about seven per sample. Only one sample contained no specimens, while in nine similar samples taken at stations with soundings of 293 m. or less, a single adult specimen was found.

It appears, therefore, that although under the conditions when the samples were taken adult Ostracods occurred near the surface at stations where the water was deep, at the shallower water stations over the Continental Shelf there must have been some factor or factors (connected for example with temperature or water movements) which limited their spread.

DEPTH DISTRIBUTION

Although Fowler's work (1909) in the Bay of Biscay is marred (as pointed out by Skogsberg, 1920) by a number of taxonomic errors, it is still clear from his results that in a number of species of the Halocypridae there is a vertical nocturnal migration, and that each species has an optimum depth of occurrence in particular conditions. Certain species in the present series of samples occur in sufficient numbers to indicate similar results. A graphical representation of the depth distribution of the adults of these species is given in Figs 4 and 5. (These figures are corrected for the differing lengths of the column through which the nets were hauled.) In the case of *C. elegans* (Fig. 4) it is clear that the distribution of the species is centred around a depth of from 250 to 500 m. At Station WS 977 a large

number of specimens were found in the 50–0 m. sample, indicating a swarm of a part of the population near to the surface. This station was worked at night, while the neighbouring Stations WS 976 and 978, where this phenomenon is not found, were worked during the day. This then would indicate that a nocturnal migration to the surface might be taking place. Similarly at Station WS 986 and 996 in daytime the majority were at 250–500 m., while at WS 997 at night, though the catch was small, there is evidence of a movement towards the surface. Fowler (1909) does in fact show such a migration for this species.

C. nasotuberculata (Fig. 5) and *C. curta* (Fig. 4) also show a depth distribution centred about 500–250 m. or rather less, though, in the latter case, the numbers are only sufficient at Stations WS 976 and 996 to indicate this. The rise in numbers of *C. nasotuberculata* above 250 m. at Station WS 977 may indicate a vertical migration, but in neither species is there a clear indication of such a migration as in the case of *C. elegans*.

The numbers of *C. alata* were much smaller but as will be seen from the Appendix (pp. 276–8), the majority of those specimens captured were in the 500–250 and 750–500 m. samples. This indicates a distribution around a level of about 500 m., or rather deeper than in the case of the three species already considered.

C. teretivalvata occurred in moderately large numbers (Fig. 5). Here the indications are that this species is distributed around a depth of 250–100 m., or at a much less depth than the other species considered. A large number of adults of the species occurred in the 750–500 m. sample at Station WS 976, but on the basis of the data available no explanation can be offered for this. There are some indications of nocturnal migration to the surface at Station WS 977.

Some of the species such as *C. symmetrica* occur in large numbers at depths of 1000 m. or more; hence the small numbers of these species in the samples may be due to the absence of samples from depths of more than 1000 m. It seems that, at the time when the samples were taken, the majority of the species found in moderate numbers in the samples had a greatest density of population at depths between 250 and 750 m.

SUMMARY

The Ostracod material from samples collected by the 'William Scoresby' during a first survey of the Benguela current (March 1950) has been examined. Twenty-three species of the genus *Conchoecia* have been identified and numbers of adult males and females as well as juveniles determined for each species. Single juveniles of *Halocypris brevirostris* and a *Cypridina* sp. were also present.

Data regarding depth distribution obtained by means of closing-nets, together with morphological examination, has made it possible to conclude that the Ostracods described previously under the name *Conchoecia rotundata* Müller are probably three closely allied species. Two of these species present in the Benguela current have been re-named.

An almost complete absence of specimens has been noticed in samples taken over the Continental Shelf. This is in contrast to the presence of quite a number of specimens of several species in samples taken at similar depths at deeper water stations.

A few species were present in sufficient numbers to obtain indications of their depth distribution.

There is evidence of a nocturnal migration towards the surface in *C. elegans* Sars.

C. echinata Müller and *C. obtusata* Sars var. *antarctica* Müller have been found south and north of their previously known areas of distribution respectively.

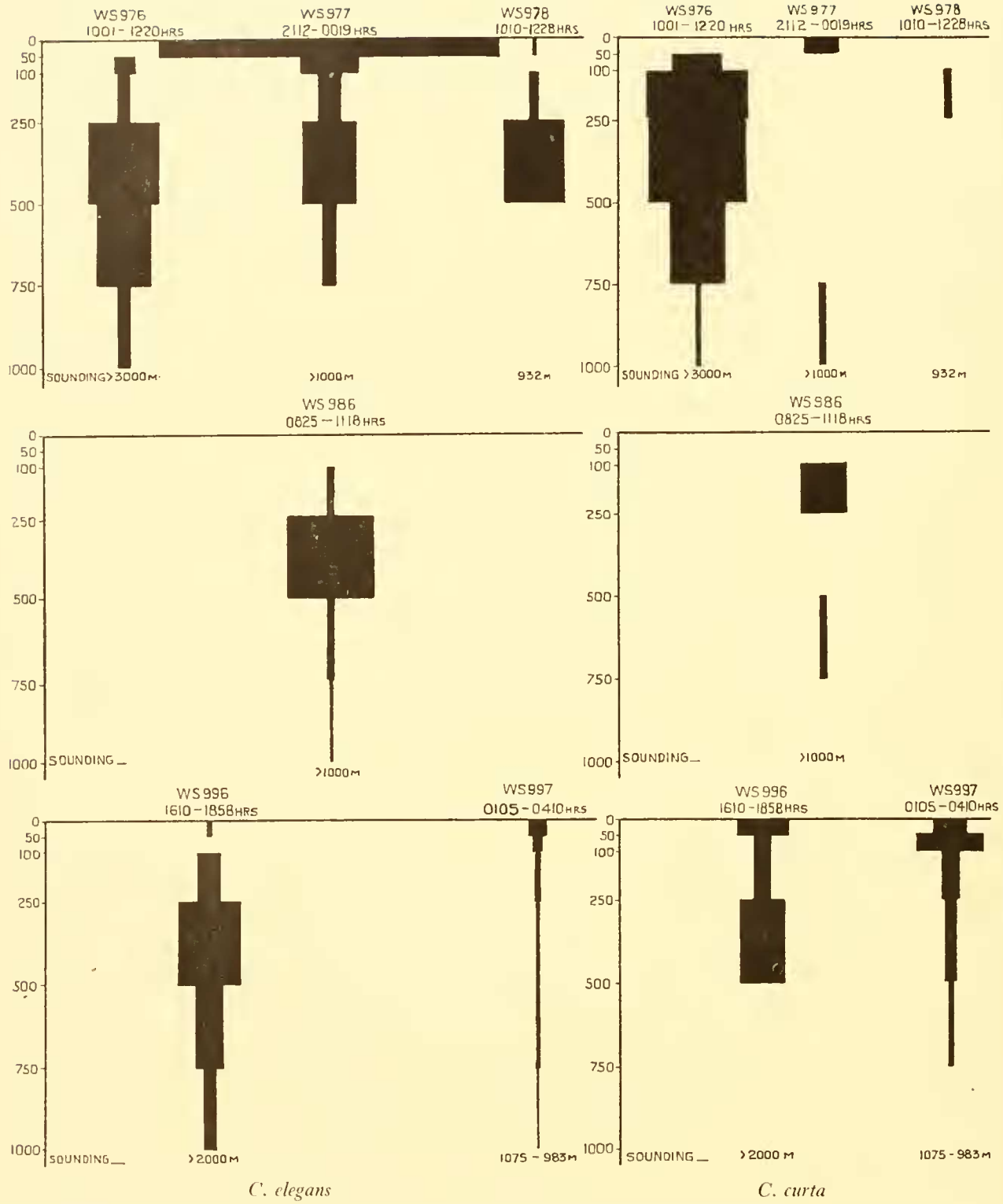
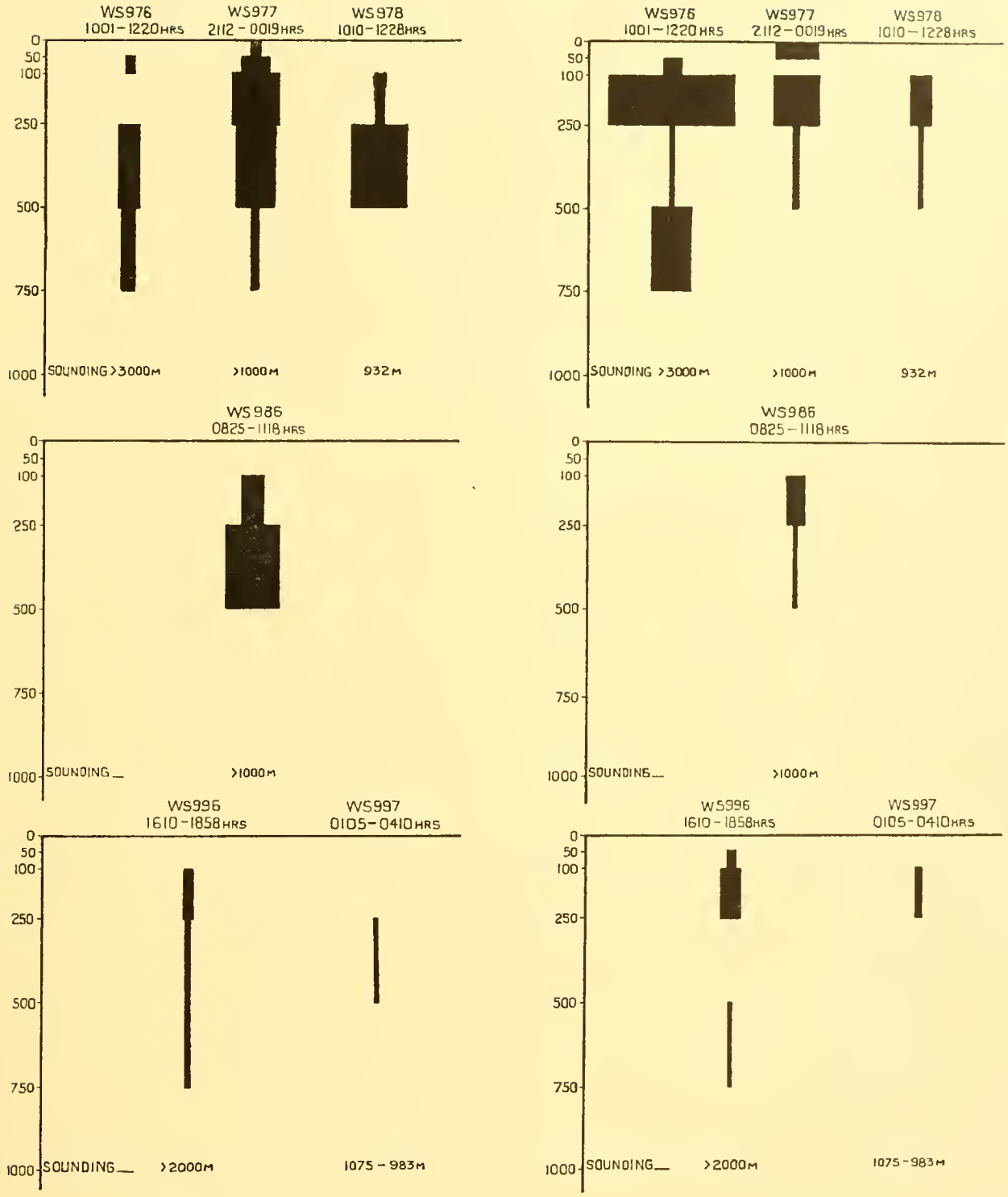


Fig. 4. Diagram to illustrate the depth distribution of *C. elegans* and *C. curta* on the basis of average numbers of adults of each species for each 50 m. of depth in each sample. The horizontal scale is the same for all diagrams of any one species but differs for different species.



C. nasotuberculata *C. teretivalvata*

Fig. 5. Diagrams constructed as Fig. 4 to illustrate the depth distribution of *C. nasotuberculata* and *C. teretivalvata*.

APPENDIX

Station WS 976. Date 6. iii. 50. Position 22° 50′ S., 11° 38′ E. Time 10 01–12 20 hr. Sounding 3098 m. 50–0 m. sample contained no Ostracods.

	100–50 m.			250–100 m.			500–250 m.			750–500 m.			1000–750 m.		
	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.
C. alata	0	0	0	0	0	0	9	0	8	5	4	10	2	0	0
C. bispinosa	0	0	0	1	0	3	3	5	10	8	3	6	0	0	0
C. curta	1	2	2	11	7	13	17	12	11	8	9	13	1	0	1
C. daphnoides	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
C. echinata	0	0	0	1	0	1	2	7	5	3	1	5	0	0	0
C. edentata	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
C. elegans	4	1	0	8	0	0	59	26	40	45	21	15	13	0	0
C. haddoni	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0
C. lophura	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
C. loricata	0	0	0	0	0	0	0	1	12	0	1	2	0	0	0
C. mamillata	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
C. nasotuberculata	1	0	2	0	0	0	9	3	28	1	7	22	0	0	0
C. obtusata	0	0	0	1	1	4	1	0	1	4	1	0	1	0	1
C. procera	0	0	0	0	0	1	1	3	1	0	0	4	0	0	0
C. skogesbergi	0	0	0	0	0	1	0	0	1	1	0	1	0	0	0
C. spinifera	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
C. subarcuata	0	1	2	2	2	21	0	1	31	0	0	6	0	0	0
C. symmetrica	0	0	0	0	0	2	2	0	8	1	0	9	2	0	5
C. teretivalvata	2	0	2	26	19	9	2	0	2	19	5	4	0	0	0
Unidentified	0	0	3	0	0	48	0	0	90	0	0	123	0	0	20

Station WS 977. Date 6/7. iii. 50. Position 22° 39′ S., 12° 16′ E. Time 21 12–00 19 hr. Sounding 1970 m. nearby later.

	50–0 m.			100–50 m.			250–100 m.			500–250 m.			750–500 m.			1000–0 m.		
	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.
C. alata	0	0	1	0	0	0	0	0	4	6	2	36	5	5	0	8	6	72
C. curta	2	0	2	0	0	4	0	0	1	0	0	0	0	0	0	0	2	4
C. echinata	0	0	0	1	0	0	0	0	0	2	1	1	1	0	0	2	2	4
C. elegans	50	33	46	7	7	6	7	8	24	37	27	55	15	1	1	120	104	258
C. loricata	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	1	0	1
C. nasotuberculata	1	0	0	0	3	0	8	9	3	8	14	54	3	1	8	23	19	156
C. obtusata	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C. procera	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
C. skogsbergi	0	0	0	0	0	0	0	0	0	4	3	2	0	0	0	3	2	2
C. subarcuata	0	0	0	0	1	0	1	0	8	0	2	3	0	0	0	1	1	10
C. symmetrica	0	0	0	0	0	0	0	0	0	1	0	1	0	0	9	2	2	10
C. teretivalvata	4	1	4	0	0	0	11	5	5	1	1	1	0	0	0	5	10	21
Unidentified	0	0	11	0	0	0	0	0	0	0	0	137	0	0	22	0	0	295

Station 978. Date 7. iii. 50. Position 22° 28′ S., 14° 42′ E. Time 1010–1228 hr. Sounding 932 m.

	50–0 m.			250–100 m.			500–250 m.			500–350 m.			750–500 m.		
	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.
C. alata	0	0	0	1	1	0	7	2	29	4	4	17	8	0	0
C. curta	0	0	0	0	1	3	0	0	7	0	0	0	0	0	0
C. echinata	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0
C. elegans	0	1	0	4	2	1	52	19	62	16	8	6	0	0	1
C. loricata	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
C. nasotuberculata	0	0	0	1	2	3	20	13	49	10	13	64	0	0	0
C. skogsbergi	0	0	0	0	0	0	3	2	1	4	0	2	0	0	0
C. subarcuata	0	0	0	1	0	1	0	2	3	0	0	0	0	0	1
C. symmetrica	0	0	0	0	0	1	0	0	0	0	0	3	0	0	0
C. teretivalvata	0	0	0	5	2	4	2	0	2	0	0	0	0	0	0
Cypridina sp.	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Unidentified	0	0	0	0	0	18	0	0	191	0	0	118	0	0	11

No Ostracods were found in the 100–50 m. sample.

Station 979. Date 7. iii. 50. Position 22° 47′ S., 13° 35′ E. Time 2225–2255 hr. Sounding 139 m. Samples taken at 50–0 and 100 to 50 m. contained no Ostracods.

Station 980. Date 8. iii. 50. Position 22° 44′ S., 14° 08′ E. Time 0255–0325 hr. Sounding 106 m. Sample taken 50–0 m. contained no Ostracods; the 100–50 m. sample contained a single female *C. teretivalvata*.

Station WS 981. Date 8. iii. 50. Position 22° 44′ S., 14° 20′ E. Time 0635–0701 hr. Sounding 64 m. A sample taken 50–0 m. contained no Ostracods.

Station WS 986. Date 10. iii. 50. Position 25° 15′ S., 13° 06′ E. Time 0825–1118 hr. Sounding > 1000 m.

	100–50 m.			250–100 m.			500–250 m.			750–500 m.			1000–750 m.		
	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.
C. alata	0	0	0	0	1	9	1	0	68	1	0	0	1	0	0
C. bispinosa	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0
C. curta	0	0	2	4	4	21	0	0	0	2	0	1	0	0	2
C. daphnoides	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
C. echinata	0	0	0	0	0	0	1	1	5	0	0	0	0	0	0
C. elegans	0	0	0	3	2	23	65	38	174	6	1	0	3	0	0
C. hirsuta	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
C. lophura	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0
C. loricata	0	0	0	0	0	0	1	0	0	1	1	0	0	0	3
C. macromma	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
C. nasotuberculata	0	0	0	6	1	3	15	17	51	0	0	0	0	0	0
C. skogsbergi	0	0	0	0	0	0	3	1	2	0	0	0	3	0	0
C. subarcuata	1	1	0	0	0	3	0	0	2	0	0	0	0	0	0
C. symmetrica	0	0	0	0	0	0	0	0	3	0	0	4	1	1	7
C. teretivalvata	0	0	0	5	1	10	1	0	2	0	0	0	0	0	0
Unidentified	0	0	0	0	0	5	0	0	70	0	0	8	0	0	8

The 50–0 m. sample contained no Ostracods.

Station WS 987. Date 10. iii. 50. Position 25° 13′ S., 13° 43′ E. Time 1822–1955 hr. Sounding 293 m. Samples taken 50–0, 100–50 and 250–100 m. contained no Ostracods.

Station WS 988. Date 11. iii. 50. Position 25° 12′ S., 14° 22′ E. Time 0035–0115 hr. Sounding 135 m. Samples taken 50–0 and 100–50 m. contained no Ostracods.

Station WS 989. Date 11. iii. 50. Position 25° 11′ S., 14° 39′ E. Time 0303–0322 hr. Sounding 70 m. A sample taken 50–0 m. contained no Ostracods.

Station WS 996. Date 12. iii. 50. Position 28° 41′ S., 13° 25′ E. Time 1610–1858 hr. No sounding.

	50–0 m.			100–50 m.			250–100 m.			500–250 m.			750–500 m.			1000–750 m.		
	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.
C. alata	0	0	1	0	0	0	0	0	0	2	0	6	0	0	6	1	0	1
C. bispinosa	0	0	0	0	0	0	2	0	1	1	0	8	0	0	0	0	0	0
C. chuni	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
C. curta	2	1	1	1	0	0	1	2	7	8	5	8	0	0	3	0	0	0
C. daphnoides	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
C. echinata	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
C. elegans	1	0	1	0	0	0	9	7	20	43	31	62	24	7	10	9	3	3
C. haddoni	0	0	0	0	0	0	0	0	0	4	0	1	2	1	0	1	0	0
C. lophura	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
C. loricata	0	0	0	0	0	0	0	0	0	1	0	4	0	0	3	0	0	0
C. mollis aff.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
C. nasotuberculata	0	0	0	0	0	0	0	3	0	0	3	2	0	3	2	0	0	0
C. obtusata	0	0	0	0	0	0	3	1	0	1	0	0	0	0	0	0	0	0
C. procera	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
C. skogsbergi	0	0	0	0	0	0	1	0	0	0	0	0	1	0	2	0	0	2
C. spinifera	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
C. subarcuata	0	0	0	0	0	0	0	0	9	0	0	3	0	0	0	0	0	0
C. symmetrica	0	0	0	0	0	1	0	0	0	0	0	13	0	0	20	1	2	1
C. teretivalvata	0	0	0	1	0	0	2	5	1	0	0	0	0	1	0	0	0	0
Unidentified	0	0	3	0	0	3	0	0	43	0	0	76	0	0	36	0	0	10

Station WS 997. Date 13. iii. 50. Position 28° 40′ S., 14° 06′ E. Time 0105–0410 hr. Sounding 1075–983 m.

	50–0 m.			100–50 m.			250–100 m.			500–250 m.			750–500 m.			1000–750 m.		
	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.	♀	♂	juv.
C. alata	0	0	0	0	0	0	0	0	0	1	0	0	1	0	2	0	0	0
C. bispinosa	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
C. curta	0	2	5	3	1	29	0	3	18	3	0	9	0	1	3	0	0	2
C. daphnoides	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
C. echinata	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
C. elegans	4	0	2	1	1	26	2	1	10	1	1	16	2	0	5	1	0	3
C. haddoni	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
C. lophura	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
C. loricata	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
C. nasotuberculata	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
C. obtusata	0	0	0	0	0	0	2	1	3	4	3	6	0	0	1	0	0	0
C. skogsbergi	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
C. subarcuata	0	0	3	0	0	3	1	0	3	0	0	3	1	0	1	1	0	0
C. symmetrica	0	0	0	0	0	0	0	0	0	1	0	2	1	0	2	2	1	2
C. teretivalvata	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Halocypris globosa	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Unidentified	0	0	0	0	0	3	0	0	4	0	0	29	0	0	42	0	0	7

Station WS 998. Date 13. iii. 50. Position 28° 40′ S., 14° 43′ E. Time 0810–0850 hr. Sounding 198 m. In the 50–0 m. sample there were no Ostracods. The 100–50 m. sample contained one juvenile not yet identified and the 175–100 m. sample contained one female *C. elegans*, one female and one juvenile *C. obtusata* and one male *C. teretivalvata*.

Station WS 999. Date 13. iii. 50. Position 28° 38′ S., 14° 49′ E. Time 1125–1200 hr. Sounding 171 m. Samples taken 50–0, 100–50 and 175–100 m. contained no Ostracods.

Station WS 1000. Date 13. iii. 50. Position 28° 40′ S., 15° 29′ E. Time 1940–2030 hr. Sounding 188 m. Samples taken 50–0, 100–50 and 150–100 m. contained no Ostracods.

Station WS 1001. Date 14. iii. 50. Position 28° 40′ S., 15° 56′ E. Time 0005–0140 hr. Sounding 121 m. A sample taken 50–0 m. contained no Ostracods. A 100–50 m. sample contained a single juvenile of *C. curta*.

Station WS 1002. Date 14. iii. 50. Position 28° 40′ S., 16° 14′ E. Time 0302–0330 hr. Sounding 69 m. Sample taken 50–0 m. contained no Ostracods.

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